

## WASTE UTILIZATION (ACRE)

CODE 633

### MONTANA TECHNICAL GUIDE

### SECTION IV

#### DEFINITION

Using agricultural wastes such as manure and wastewater or other organic residues.

#### PURPOSE

**This practice is applied as part of a total resource management system to:**

- Protect water quality.
- Provide fertility for crop, forage, fiber production and forest products.
- Provide feedstock for livestock.
- Utilize manure and other organic nutrient sources as a plant amendment or soil conditioner.
- Provide a source of energy.
- Improve or maintain soil structure.

#### CONDITIONS WHERE PRACTICE APPLIES

This practice applies to **all land** where agricultural wastes including animal manure and contaminated water from livestock and poultry operations; solids and wastewater from municipal treatment plants; and agricultural processing residues are generated, and/or utilized including cropland, pastureland, hayland, and rangeland.

#### CRITERIA

##### General Criteria Applicable to All Purposes.

##### *Regulations*

All federal, state and local laws, rules and regulations governing waste management, pollution abatement, health and safety shall be strictly adhered to. The owner or operator shall be responsible for securing any and all required permits or approvals related to waste utilization, and for operating and maintaining any components in accordance with applicable laws and regulations.

**Organic nutrient application to land must comply with the most restrictive of federal, state, or county laws, ordinances and permit conditions. Montana Water Quality Act, Section 75-5-605 (revised 1991) states that "It is unlawful to...cause pollution...of any state waters or to place or cause to be placed any wastes in a location where they are likely to cause pollution of any state waters." Refer to the Montana Supplement of the Agricultural Waste Management Field Handbook, Part 651, Chapter 1, for a listing of pertinent state laws and regulations regarding agricultural wastes.**

##### *Rates*

**A number of factors can affect the annual amount or rate of organic nutrient sources to be applied. Those factors include: nutrients and other elements contained in the source; soil conditions; vegetation; water quality, and limitations of application equipment.**

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**NOTE:** This type of font (**AaBbCcDdEe 123..**) indicates NRCS National Standards.  
This type of font (**AaBbCcDdEe 123..**) indicates Montana Supplement.

## Organic Nutrient Characteristics

Non-agricultural organic nutrients shall be analyzed for macro and micro nutrient contents. The generator or applier of the sludge is generally responsible for obtaining the analysis.

Use of agricultural wastes shall be based on at least one analysis of the material during the time it is to be used. In the case of daily spreading, the waste shall be sampled and analyzed at least once each year. As a minimum the waste analysis should identify nutrient and specific ion concentrations. **Samples should be analyzed for pounds per ton or pounds per 1000 gallons of Total Nitrogen (N), Phosphorus ( $P_2O_5$ ), and Potassium ( $K_2O$ ).** Where the metal content of municipal wastewater, sludge, septage, and other agricultural waste is of a concern, the analysis shall also include determining the concentration of metals in the materials. **Sampling techniques must be consistent with Agricultural Waste Management Field Manual, Chapter 16. Contact the Montana Cooperative Extension Service for labs that are certified to test agricultural wastes for nutrients. Uses of on-site analytical kits are permitted if and when endorsed by the Montana Department of Agriculture or Montana State University Extension Service. Waste samples will be gathered and analyzed annually until test results indicate consistent nutrient content over a three year period (results over three years do not deviate from each other by more than 15 percent.) Testing frequency can be reduced to once every three years if consistent nutrient content results are documented.**

Organic nutrients tested at different times of the year may vary in nutrient content due to changes in bedding, feed, amounts of water entering a storage facility, or degradation. Initially, conduct multiple within-year analyses if season of application changes or if more than one application will occur within a year.

Use published average nutrient content values only for planning and informational purposes to initially establish total quantity of manure, or to estimate total nutrients in manure for certain time periods. Refer to TABLE 2. Daily Manure Production (as excreted.)

## Soil Conditions

Soil salts (specifically salinity) may rise in areas receiving long-term applications of manure due to the inherent salt content naturally present in agricultural wastes. Reduce application rates or rotate field applications prior to soil salinity levels reaching 4 mmhos/cm. Consult the Agricultural Waste Management Field Handbook (AWMFH), Chapters 5, 6, and 11 for additional details concerning salinity hazards.

For additional soil characteristics and limitations for land application of agricultural wastes, refer to AWMFH, TABLE 5-3.

## Plant Nutrient Needs

The determination of application rates based on plant nutrient needs is the primary consideration when planning organic nutrient utilization. Criteria found in the Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications, 590–Nutrient Management, will be used to determine plant nutrient needs. Those criteria include soil testing, manure analysis, realistic yield goals, and calculating need for applied nutrients sources by accounting for nutrients already supplied by soil, previous crops, and previous manure applications. Base organic nutrient application rates on nitrogen, phosphorus, or potassium (excessive or deficient) for non-legume crops, grass hayland and grass pasture. Base organic nutrient rates on phosphorus or potassium for planned legumes. In nutrient sensitive areas, base nutrient rates on sensitive N, P, or K.

## Vegetation

Insure that timing, quantity and distribution of waste applications do not cause ammonia burn, salt damage, crown damage, or stand suffocation to established crops and forages. Refer to AWMFH, Chapter 6 for additional details concerning vegetation.

## Water Quality

The Montana Water Quality Act, Section 75-5-605 of the Act (revised 1991) states that “It is unlawful to cause pollution of any state waters or to place or cause to be placed any wastes in a location where they are likely to cause pollution of any state waters...” See AWMFH, Montana Supplement, Chapter 1. Where wastes are applied within 100 feet of surface waters, subsequent applications of manure shall not occur until the  $P_2O_5$  supplied by the application has been removed by crop(s) when a) the field is not separated from the receiving water by a filter strip (FOTG, Section IV, Practice Standards and Specifications, 393–Filter Strip); and, b) soil P levels are at or over 50ppm. See Crop P removal in definition section for details.

Liquid wastes should be spread in a manner that prevents runoff of the wastes during application. Base the application rate of liquid wastes on soil infiltration rates so as not to exceed the amount of water needed to bring soil moisture content to field capacity within the rooting zone at the time of application. The actual rate shall be adjusted during application to avoid ponding or runoff. Stop applications if runoff or ponding is observed. Procedures for determining inches per hour rates for irrigated liquid manure is found in Chapter 11 of AWMFH.

## Application Equipment

Evaluate equipment to determine the capacity to regulate varying application rates. For example, utilizing an applicator that can only be adjusted in units of 1,000 is not appropriate for a design that calls for 3,400 gallons/acre. Do not design a system calling for numerous rates unless and until variable rate manure application equipment is available to producer. Do not design a system for a low application rate that the applicator is not capable of delivering. For example, designing a system calling for a different rate on each of 15 fields would require numerous calibrations, calculations, and documentation.

Records of the use of wastes shall be kept a minimum of three years as discussed in the **OPERATION AND MAINTENANCE** below.

## Location, Incorporation, and Timing

### Location

*Do not apply organic nutrients:*

1. within 25 feet of any state waters.
2. within 50 feet of residences, active or inactive water supply wells, mines, quarries, sinkholes receiving surface runoff, or other direct conduits to ground water.
3. to established grassed waterways, ditches, or other water conveyance system.
4. on fields with predicted water erosion rates greater than 5 T/A/Y (RUSLE).
5. where a minimum separation distance of 15 inches cannot be maintained between injected, incorporated, or unincorporated manure and fractured bedrock.
6. Where agricultural wastes are to be spread on land not owned by the producer, the waste management plan, as a minimum, shall document the amount and concentration of waste to be transferred and who will be responsible for the environmentally acceptable use of the waste.

### Incorporation

Incorporation of wastes is encouraged to minimize odor and nutrient and pathogenic organism loss to the environment. The following criteria establish maximum times to incorporation:

1. Inject or incorporate within 24 hours if applied on:
  - a) sites within 1000 feet of residential areas;
  - b) sites within 300 feet of active or inactive water supply wells, mines, quarries, and sinkholes receiving surface runoff or other direct conduits to groundwater;
  - c) soils classified by NRCS as frequently flooded ( $\geq 50$  times in 100 years). Incorporation on frequently or occasionally flooded soils can be delayed for up to 4 days when flooding probability is low.

2. Inject or incorporate within 48 hours if applied on land within:
  - a) sites within 1000 feet of residential areas;
  - b) 300 feet of surface waters if a filter strip does not separate the field from the receiving water.
3. Inject or incorporate manure within 72 hours on soils classified by NRCS as occasionally flooded (5-50 times in 100 years).

### **Timing**

Fall applications on coarse textured soils (see definition section) are not allowed. Delay fall applications on coarse textured soils until daily average soil temperatures at a six inch depth are below 50 degrees F.

Inject or incorporate during periods of the year when the water table is greater than 20 inches from the soil surface.

Apply in the morning to minimize odor if applications on warm days are necessary.

Avoid compaction on medium and fine textured soils by applying when soil moisture content is significantly less than field capacity (field is in a good tillable condition).

### **Additional Criteria For Providing Fertility For Crop, Forage, Fiber Production and Forest Products**

Where agricultural wastes are utilized to provide fertility for crop, forage, fiber production, and forest products, the Montana FOTG, Section IV, Practice Standard 590–Nutrient Management shall be followed.

Application of organic waste containing high amounts of heavy metals can exceed the adsorptive capacity of the soil and increase the potential for ground water or aquifer contamination. Where municipal wastewater and solids are applied to agricultural lands as a nutrient source, the single application or lifetime limits of heavy metals shall not be exceeded. Sandy soils with low organic matter and low pH have a low potential for retention of heavy metals. These soils have the highest potential for heavy metal and trace element contamination of ground water. TABLE 1–

**Recommended Soil Test Limits of Metals**, identifies the recommended cumulative limits for metals of major concern by EPA when wastes are applied to agricultural land. The concentration of salts shall not exceed the level that will impair seed germination or plant growth (4 mmhos).

TABLE 1. Recommended Soil Test Limits of Metals\*

METAL	--SOIL CATION EXCHANGE CAPACITY, MEQ/100G --		
	<5	5 to 15	>15
	----- LB./AC -----		
Pb	500	1,000	2,000
Zn	250	500	1,000
Ni	125	250	500
Cd	4.4	8.9	17.8

\* USEPA 1983, taken from AWMFH, 04/92.

### **Additional Criteria For Improving or Maintaining Soil Structure**

Wastes shall be applied at rates not to exceed the crop nutrient requirements or salt concentrations as stated above, and shall be applied at times the waste material can be incorporated by appropriate means into the soil within 72 hours of application. **Manure with high C:N ratio (>30:1) will improve soil structure rapidly.**

### **Additional Criteria For Providing Feedstock For Livestock**

Agricultural wastes to be used for feedstock shall be handled in a manner to minimize contamination and preserve its feed value. Chicken litter stored for this purpose shall be covered. A qualified animal nutritionist shall develop rations, which utilize wastes.

### **Additional Criteria For Providing A Source of Energy**

Use of agricultural waste for energy production shall be an integral part of the overall waste management system.

All energy producing components (i.e. digester, generator, power lines) of the system shall be included in the waste management plan and provisions for utilization of residues of energy production identified.

Where the residues of energy production are to be land-applied for crop nutrient use or soil conditioning, the criteria listed above shall apply.

#### **Additional Criteria For Organic Nutrients On Agricultural Land When Vegetation Is Not Harvested**

Apply organic nutrients to CRP, USDI–Bureau of Land Management (BLM) or similar land only after obtaining approval from the appropriate agency. Contact USDA–Farm Service Agency for application on CRP land, USDA–Forest Service for application on national forest lands, and USDA–BLM for application on BLM lands.

Apply organic nutrients only in emergency type situations on:

- frozen soils;
- saturated soils;
- snow-covered land.

Plan application rates on the amount needed to supply up to 30-lbs./ac. nitrogen (N) on coarse textured soils and up to 60 lbs./ac. N on other soil types (allow up to 80 lbs./ac. N on other than coarse textured soils for drag hose type applications). For nutrient application rates on Critical Area Treatment land, see FOTG, Section IV, Practice Standard 342–Critical Area Treatment.

Only apply on areas that do not contribute to runoff to receiving waters. Avoid manure applications in a buffer or filter area.

Time application to periods of greatest plant nutrient uptake. Do not apply when the ground is frozen, snow covered, or actively thawing (i.e. during periods of freeze/thaw).

Do not apply organic nutrients on soils defined as frequently flooded, by the National Cooperative Soil Survey ( $\geq 50$  times in 100 years).

Test for soil P and K content once every three years and cease applications when test results indicate  $P \geq 50$  Olsen phosphorus or  $K \geq 200$ .

Leave a portion of the total area undisturbed (do not apply wastes) during each application to minimize disruption of nesting activities and temporary destruction of wildlife habitat.

#### **Additional Criteria For Irrigated Lands**

Time applications of wastes and water so that runoff to a “state water” does not occur.

Considerations should include expected rainfall periods, precipitation, frozen soil, and snow melt periods.

Water application must maximize irrigation water efficiency to negate potential percolation of nutrients and ground water contamination, See FOTG, Section IV, Practice Standards and Specifications, 449–Irrigation Water Management.

#### **Additional Criteria To Protect Water Quality**

All agricultural waste shall be utilized in a manner that minimizes the opportunity for contamination of surface and ground water supplies.

Agricultural waste shall not be land-applied on soils that are frequently flooded, as defined by the National Cooperative Soil Survey, during the period when flooding is expected.

When liquid wastes are applied, the application rate shall not exceed the infiltration rate of the soil, and the amount of waste applied shall not exceed the moisture holding capacity of the soil profile at the time of application. Wastes shall not be applied to frozen or snow-covered ground.

### **CONSIDERATIONS**

Waste utilization is an integral part of a waste management system that recycles livestock and other agricultural wastes. The objective is to manage wastes in quantities that benefit plants, limits nutrient or harmful contaminant movement into surface or ground water, does not contaminate crops that are food supply with pathogens or toxic concentrations of metals or other organics, and provides a medium to fix and/or transform nonessential elements and compounds into harmless forms.

Waste utilization must balance the capacity of the soil and plant growth to transform nutrient elements applied in manures with the amount residual in the system. A lack of plant nutrients can create deficiencies and an excess can cause toxicity. Both adversely impact plant growth. Elements that are not retained, transformed, or

utilized by the plants have the potential of leaving the system and becoming a contaminant to surface and/or groundwater.

**Nitrogen and phosphorus are the two critical nutrients in addressing water quality issues. Consider nutrient form, methods of application, rates, and timing, to conform to seasonal variation in plant needs.**

**Plan erosion control measures to minimize soil erosion and runoff that may carry attached and dissolved livestock and other agricultural waste nutrients to surface waters.**

**Where possible, establish and maintain vegetated buffer areas around sinkholes, surface waters and surface tile inlets.**

The effect of Waste Utilization on the water budget should be considered, particularly where a shallow groundwater table is present or in areas prone to runoff. Limit waste application to the volume of liquid that can be stored in the root zone.

Minimize the impact of odors of land-applied wastes by making application at times when temperatures are cool and when wind direction is away from neighbors.

Agricultural wastes **may** contain pathogens and other disease-causing organisms. Wastes should be utilized in a manner that minimizes their disease potential.

Priority areas for land application of wastes should be on gentle slopes located as far as possible from waterways. When wastes are applied on more sloping land or land adjacent to waterways, other conservation practices should be installed to reduce the potential for offsite transport of waste.

It is preferable to apply wastes on pastures and hayland soon after cutting or grazing before growth has occurred.

Reduce nitrogen volatilization losses associated with the land application of some waste by incorporation within 24 hours.

Minimize environmental impact of land-applied waste by limiting the quantity of waste applied to **land using** the rates determined using the Montana practice standard 590–Nutrient Management for all waste utilization.

Consider the use of enzyme additives such as phytase to improve animal ability to utilize P in their rations reducing P excreted in feces (applies mostly to swine and poultry).

Consider various uses of organic nutrients when developing a utilization plan (i.e. composted potting medium and feed).

Consider composting to reduce volume of wastes generated or to dispose of deceased animals (poultry, hogs).

## **PLANS AND SPECIFICATIONS**

Plans and specifications for Waste Utilization shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The waste management plan is to account for the utilization or other disposal of all animal wastes produced, and all waste application areas shall be clearly indicated on a plan map.

**Data shall be recorded on specification sheets and job sheets for nutrient management and Ag waste utilization, including narrative statements in the conservation plan.**

**An agricultural waste utilization plan shall include the following:**

- 1. Location map - field numbers and a map or sketch of the area to be used.**
- 2. Measured acres.**
- 3. Date practice scheduled and applied.**
- 4. A description of the size and kind of livestock present including quantity or organic materials produced during the planning period.**
- 5. A brief description of the manure storage and handling system including application equipment and labor needed to apply the organic nutrient source.**
- 6. Identification of critical areas where special attention is required when applying organic wastes including areas where nutrients will not be applied (e.g. waterways); areas where immediate incorporation or incorporation within 24-72 hours will be necessary; and areas where wintertime applications should be minimized or eliminated; where soil test P and**

K levels are high. Identify sinkholes, wells, high water table soils, frequently flooded soils, and other critical areas.

7. A schedule of application (MT-CPA-225, MT-CPA-226) to include per acre annual rates, frequency of application (if applied more than once in the cropping year to the same field), anticipated month of application(s), time to incorporation after application, and amounts of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O available to plants at the prescribed rate.
8. Calculations and data used to develop the application schedule. This information includes calculations of the operation's organic nutrients available to the crop after application (MT-CPA-223, MT-CPA-224).
9. Montana FOTG Form 590–Nutrient Management, MT-ECS-112, must be used when developing nutrient management plans.
10. Waste disposal including mass and concentration transported from farm.
11. All operation & maintenance activities.

## OPERATION AND MAINTENANCE

1. Records shall be kept for a period of five years or longer, and include when appropriate:
  - Quantity of manure and other agricultural waste produced and their nutrient content.
  - Soil test results, waste nutrient levels.
  - Dates and amounts of waste application where land applied, and the dates and amounts of waste removed from the system due to feeding, energy production, or export from the operation.
  - Waste application methods.
  - Crops grown and yields (both yield goals and measured yields).
  - Calibration and inspection of application equipment.
  - The operation and maintenance plan shall include the dates of periodic inspections and maintenance of equipment and facilities used in waste utilization. The plan should include what is to be inspected or maintained, and a general time frame for making necessary repairs.

2. Assure that application or spreading pattern is uniform so that the amount specified for a particular area is applied across the entirety of the area.

## DEFINITIONS

**Coarse Textured Soils**—Coarse textured soils apply to the surface soil texture and/or the subsoil texture within three feet of the surface. These textures include sand, loamy sand, loamy coarse sand, fine sand, loamy fine sand, loamy very fine sand, coarse sand, very fine sand, sandy loam, coarse sandy loam, fine sandy loam, and any of the above listed textures with gravelly or very gravelly modifiers.

**Crop Phosphorus Removal Rate**—Crop P removal rates for the purposes of this standard is the quantity of P taken up by a specific crop for a specific yield and removed in the harvested portion of that crop. The quantity is independent of the source of the P and can be based on the P need of the current planned crop and following crop(s) provided that no additional applications occur until the planned time period has elapsed. (i.e. do not re-apply until the third crop year after the current year if the planned rate will supply enough phosphorus for the current and following two years' crops). Crop P removal rates will be consistent with Montana State University recommendations. A procedure to calculate removal rates is found in Chapter 6 of the AWMFH.

**Filter Strips**—Filter strips for purposes of this standard are strips of ungrazed permanent perennial plant species with growth patterns conducive to retarding runoff flow velocities. Tall, upright, sod-forming grasses are recognized as the ideal filter strip vegetation. Strips of permanent vegetation which have much of a field's runoff conveyed through them as concentrated flow, will not filter effectively and should not be considered as filter strips. Strip widths for purposes of this standard shall be consistent with the most current Montana FOTG, Section IV, Practice Standard 393–Filter Strip.

**Intermittent Streams**—Intermittent streams include off-field drainage channels with definable banks that provide for seasonal water flow to a perennial stream, lake, wetland or water flow during snowmelt or rainfall events.

**Surface Waters**—Surface waters for purposes of this standard include lakes, perennial streams, Montana regulated wetlands, off-field intermittent streams, off-field drainage ditches, and other water bodies considered locally important.

**State Waters**—State Waters means “any body of water, irrigation system, or drainage system, either surface or underground” except “irrigation waters where the waters are used up within the irrigation system and the waters are not returned to any other state waters.”

**Wastes**—Wastes include: manure, composted manure or carcasses, bedding, municipal or industrial treatment plant sewage sludge or sewage sludge compost, septic tank septage, and materials from agricultural processing plants (i.e. whey).

## REFERENCES

USDA–Natural Resources Conservation Service, Field Office Technical Guide, Section IV, Practice Standard 590–Nutrient Management, March 2000.

USDA–Natural Resources Conservation Service, Field Office Technical Guide, Section IV, Practice Standard 393–Filter Strip, April 1999.

Using Whey on Agricultural Land—A disposal Alternative. 1981. University of Wisconsin Extension Publication A3098.

USDA–Natural Resources Conservation Service, Agricultural Waste Management Field Handbook, Part 651. 1992.

Montana's Nondegradation Policy, Montana Department of Agriculture, Water Quality Division, Ground Water Section. 1991.

USDA–Natural Resources Conservation Service, Field Office Technical Guide, Section IV, Practice Standard 449–Irrigation Water management, March 1999.

**Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.**